Clinical Echocardiography in Canines: Techniques, Applications and Diagnosis

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OPEN ACCESS

Keywords

Canine echocardiography, Veterinary cardiology, Myxomatous mitral valve disease (MMVD), Dilated cardiomyopathy (DCM)

How to cite this article:

Karir, S. R., Bharia, A., Chaudhary, S. and Kumar, L. 2025. Clinical Echocardiography in Canines: Techniques, Applications and Diagnosis. *Vigyan Varta* 6 (5): 38-41.

ABSTRACT

Echocardiography is a vital diagnostic tool in veterinary cardiology, providing non-invasive, real-time assessment of cardiac structure and function. This article summarizes key principles, techniques and clinical applications of echocardiography in canine patients, offering veterinary professionals a concise overview to aid in diagnosing and managing cardiac diseases.

INTRODUCTION

Heart disease in dogs, particularly in senior and genetically predisposed breeds, is common and often progressive. Echocardiography has become indispensable for the diagnosis, management and monitoring of cardiovascular conditions in canines. It allows for a thorough examination of the heart's structure, function and blood flow dynamics (Boon, 2011).

The advantages of echocardiography lie in its ability to provide live images of cardiac function, assess blood flow with Doppler

technology and guide treatment decisions. With a growing number of canine cardiac patients, echocardiography helps veterinarians evaluate conditions such as myxomatous mitral valve disease (MMVD), dilated cardiomyopathy (DCM) and pericardial effusion efficiently and effectively (Thomas *et al*., 1993).

Echocardiographic Techniques

1. Two-Dimensional Echocardiography (2D Echo)

2D echocardiography is the fundamental method for visualizing the heart's anatomy. It enables the assessment of:

- Chamber sizes
- Valve structures
- Wall motion abnormalities
- Pericardial effusion

This technique is essential for detecting valvular thickening, chamber dilation, or intracardiac masses (Cote, 2019).

2. M-Mode Echocardiography

M-mode echocardiography provides high-resolution measurements of cardiac structures and wall motion, especially useful for:

- Left ventricular size (end-diastolic and systolic)
- Wall thickness (interventricular and posterior walls)
- Ejection fraction and fractional shortening

It helps monitor progression in conditions like dilated cardiomyopathy (Boon, 2011).

3. Doppler Echocardiography

Doppler techniques, including Color Doppler, Pulsed-Wave Doppler and Continuous-Wave Doppler, are invaluable in:

- Assessing blood flow direction
- Measuring velocity
- Detecting valvular regurgitation or stenosis

These tools are particularly important for diagnosing conditions such as myxomatous mitral valve disease and aortic stenosis (Stepien, 2011).

4. Tissue Doppler Imaging (TDI)

TDI helps assess myocardial motion and function, particularly useful in detecting early stages of heart disease before structural abnormalities appear.

❖ **Clinical Indications for Echocardiography**

Echocardiography is indicated in cases where:

- A cardiac murmur is detected
- The patient shows signs of heart failure, such as coughing, dyspnoea or exercise intolerance
- Arrhythmias are observed on ECG
- Monitoring of pre-existing heart disease or drug therapy response is required

Echocardiography is also a critical tool for dogs with breed-specific predispositions to heart disease, such as Cavalier King Charles Spaniels (MMVD) and Dobermans (DCM) (Atkins *et al*., 2009).

❖ **Interpretation of Results**

Echocardiographic interpretation involves measuring and assessing various parameters to evaluate heart function:

- Left Atrium/Aortic Root Ratio (LA/Ao): Used to assess left atrial enlargement (normal range: 1.3–1.6).

- Fractional Shortening (FS%): Indicates left ventricular systolic function (normal range: 25–45%).
- Ejection Fraction (EF%): Another measure of systolic function (normal range: 55–75%).

Additionally, Doppler techniques assess:

- Mitral and Tricuspid Regurgitation: Seen with color Doppler for mitral valve disease.
- Velocity: Measured using continuous-wave Doppler, critical for diagnosing conditions like aortic stenosis (Cote, 2019).

These parameters, when combined with clinical signs and laboratory values, allow for precise diagnosis and staging of cardiac diseases (Stepien, 2011).

❖ **Common Cardiac Conditions Diagnosed Using Echocardiography**

1. **Myxomatous Mitral Valve Disease (MMVD)**

The most common heart disease in small breeds, MMVD presents with mitral valve prolapse and regurgitation. Echocardiography shows thickened mitral valves and regurgitant jets, with Color Doppler used to evaluate the severity of mitral regurgitation (Boon, 2011).

2. Dilated Cardiomyopathy (DCM)

This condition is common in large dog breeds like Dobermans and Great Danes. Echocardiography shows ventricular dilation, decreased systolic function and poor myocardial motion. Doppler techniques help assess the severity of regurgitant flow or stenosis (Thomas *et al*., 1993).

3. Pericardial Effusion

Echocardiography is the most reliable method to detect pericardial effusion. An anechoic space surrounding the heart indicates fluid accumulation. Echocardiography can guide pericardiocentesis and monitor the amount of fluid in follow-up visits (Stepien, 2011).

4. Congenital Heart Defects

Echocardiography is crucial for diagnosing congenital heart defects such as patent ductus arteriosus (PDA), ventricular septal defects (VSD) and atrial septal defects (ASD). Doppler imaging evaluates blood flow across abnormal openings, providing information about defect severity (Cote, 2019).

❖ **Recent Advances in Echocardiography**

- Strain Imaging: This technology measures myocardial strain and provides insights into myocardial function, even in the early stages of heart disease, such as in dilated cardiomyopathy (Stepien, 2011).
- 3D Echocardiography: While still mostly used in referral centers, 3D echocardiography provides volumetric data and better anatomical detail, improving accuracy in conditions like valvular diseases (Atkins *et al*., 2009).
- Integration with Biomarkers: Combining echocardiography with biomarkers such as NT-proBNP and cardiac troponins has improved diagnostic and prognostic capabilities in canine cardiac diseases (Cote, 2019).

CONCLUSION

Echocardiography plays a pivotal role in veterinary cardiology by providing detailed, non-invasive insights into heart health. Its ability to visualize anatomical and functional abnormalities in real-time helps veterinarians diagnose heart diseases, monitor progression and tailor treatment plans. The growing integration of advanced echocardiographic techniques enhances the precision of cardiac care in dogs, ultimately improving patient outcomes.

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